ESAME FISICA 1 – 13/6/2011

Titolo nota 12/06/2011

1) $m_{Cu} = 600\ g$ $\quad T_i^{Cu} = 80\,^\circ C = 353.15\ K$

$m_{H_2O} = 70\ g$ $\quad T_i^{H_2O} = 10\,^\circ C = 283.15\ K$

T_e: $\quad m_{Cu} c_{Cu} (T_e - T_i^{Cu}) + m_{H_2O} c_{H_2O} (T_e - T_i^{H_2O}) = 0$

$$\Rightarrow T_e = \frac{m_{Cu} c_{Cu} T_i^{Cu} + m_{H_2O} c_{H_2O} T_i^{H_2O}}{m_{Cu} c_{Cu} + m_{H_2O} c_{H_2O}} = 314.05\ K = 40.9\,^\circ C$$

b) $\Delta S_{Cu} = \int_{T_i^{Cu}}^{T_e} \frac{\partial Q_{Cu}}{T} = m_{Cu} c_{Cu} \ln \frac{T_e}{T_i^{Cu}} = -27.2\ \frac{J}{K}$

c) $\Delta S_{H_2O} = \int_{T_i^{H_2O}}^{T_e} \frac{\partial Q_{H_2O}}{T} = m_{H_2O} c_{H_2O} \ln \frac{T_e}{T_i^{H_2O}} = 30.35\ \frac{J}{K}$

d) $\Delta S_{Cu+H_2O} = \Delta S_{Cu} + \Delta S_{H_2O} = 3.15\ \frac{J}{K}$

e) $\Delta S_{univ.} = \Delta S_{Cu+H_2O} = 3.15\ \frac{J}{K}$ (il contenitore è isolato $\Rightarrow \Delta S_{amb} = 0$)

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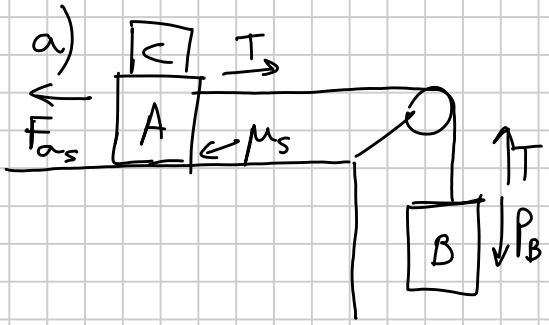
2) a)



$P_A = 44\ N$ $\quad \mu_s = 0.20$

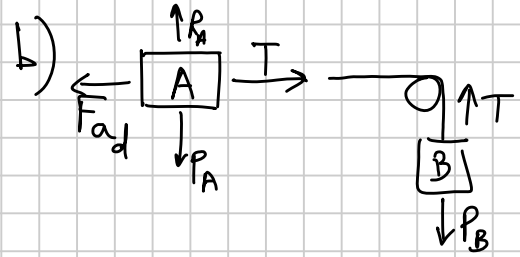
$P_B = 22\ N$ $\quad \mu_d = 0.15$

$F_{as} = P_B$ per equilibrio

$F_{as_{max}} \geq F_{as} = P_B \Rightarrow \mu_s (P_A + P_C) \geq P_B$

$$\Rightarrow P_C \geq \frac{P_B}{\mu_s} - P_A = 66\ N$$

b)



$$\begin{cases} P_B - T = m_B a = P_B \frac{a}{g} \\ T - F_{ad} = m_A a = P_A \frac{a}{g} \end{cases} \Rightarrow T = P_B \left(1 - \frac{a}{g}\right)$$

$F_{ad} = P_A \mu_d \quad \Rightarrow \quad P_B \left(1 - \frac{a}{g}\right) - P_A \mu_d = P_A \frac{a}{g}$

$$\Rightarrow (P_A + P_B)\frac{a}{g} = P_B - P_A\mu_d \Rightarrow a = \frac{P_B - P_A\mu_d}{P_A + P_B} g = \boxed{2{,}29 \ \frac{m}{s^2}}$$

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3) $\boxed{m_A} \xrightarrow{V_0} \boxed{m}$ $\qquad m_A = 2\,kg \qquad V_A^{fin} = \frac{1}{4}V_0$

a) $\begin{cases} \vec{P}_i = \vec{P}_f \\ E_i = E_f \end{cases} \qquad \begin{cases} m_A V_0 = m_A V_A^{fin} + m V^{fin} \\ \frac{1}{2} m_A V_0^2 = \frac{1}{2} m_A (V_A^{fin})^2 + \frac{1}{2} m (V^{fin})^2 \end{cases}$

$$\Rightarrow m V^{fin} = m_A \cdot \frac{3}{4} V_0 \Rightarrow \frac{1}{2} m_A V_0^2 = \frac{1}{2} m_A \frac{1}{16} V_0^2 + \frac{1}{2} \frac{m_A^2 \frac{9}{16} V_0^2}{m} \Rightarrow 1 = \frac{1}{16} + \frac{9}{16}\frac{m_A}{m}$$

$$\Rightarrow \frac{9}{16}\frac{m_A}{m} = \frac{15}{16} \Rightarrow m = \frac{3}{5} m_A = \boxed{1.2\,kg}$$

b) $p_{TOT} = m_{TOT} \cdot V_{CM} \Rightarrow m_A V_0 = (m_A + m) V_{CM}$

$V_0 = 4 \frac{m}{s} \Rightarrow V_{CM} = \frac{m_A}{m_A + m} V_0 = \boxed{2.5 \ \frac{m}{s}}$

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4) $\uparrow F$

$F_{aria} = 30\,N \qquad F_{acqua} = 20\,N \qquad F_L = 24\,N$

$\rho_L = ?$

$F_{aria} = mg \qquad F_{acqua} = mg - \rho_{H_2O} V g \qquad F_L = mg - \rho_L V g$

$$\Rightarrow F_{acqua} = F_{aria} - \rho_{H_2O} V g \Rightarrow V = \frac{F_{aria} - F_{acqua}}{\rho_{H_2O} g}$$

$$\Rightarrow F_L = F_{aria} - \rho_L \frac{F_{aria} - F_{acqua}}{\rho_{H_2O}} \Rightarrow$$

$$\Rightarrow \rho_L = \frac{F_{aria} - F_L}{F_{aria} - F_{acqua}} \rho_{H_2O} = \frac{6}{10} \rho_{H_2O} = \boxed{600 \ \frac{kg}{m^3}}$$